GRADE 10 MATH
LINEAR MODELS
WORKSHEET 3

Name: _____
Date: _____

EQUATION OF A LINE THROUGH A POINT ; PARALLEL LINES

1. Recall, the equation of a line through a *y-intercept*, ***b***, of and with slope, ***m***, is just ***y = mx +b***

2. How do we find the equation of a line through any given point **given a slope and a point**! In this case, the given point is not just a simple one like on the *y*-intercept! If we are given one point on a line and a direction of a line, we should be able to find all other points! Think about it!

3. **Example**: Find the equation of the line that has a **slope of 2** and goes through the point **(-3, -5).**

4. We know: ***y=mx* + b** is a general equation of a line. We know the ***m*** is 2 in this case. So we know that ***y* = 2*x* + b**. All we need is to find the **b**!

5. But we know that when ***x*=-3** that ***y* = -5**! Let's substitute in the ***x*** and ***y*** into what we know so far!

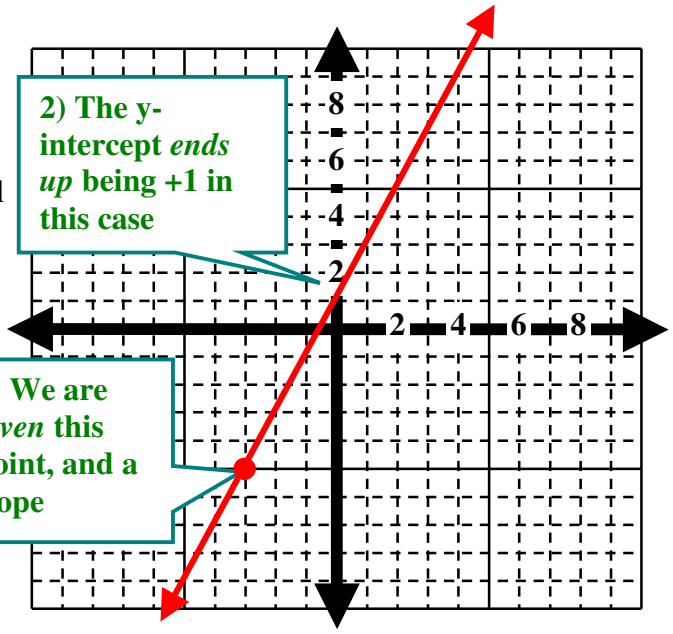
$y = 2x + b$

$-5 = 2(-3) + b$ so $-5 = -6 + b$

∴ b = 1

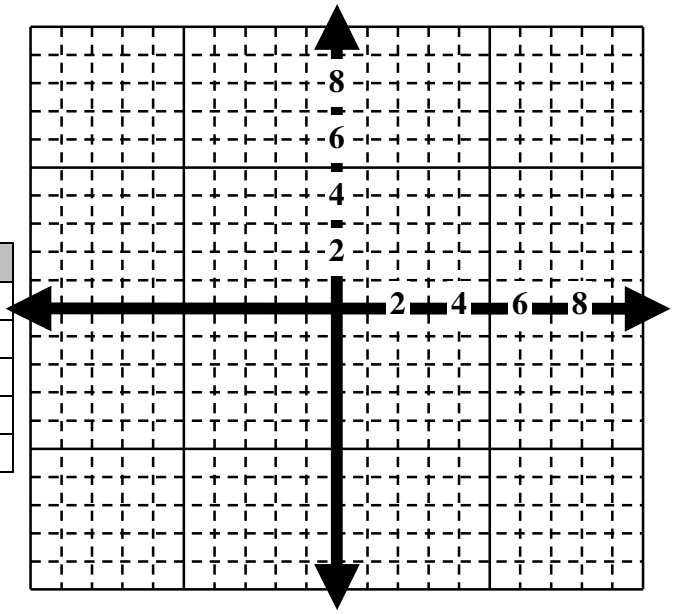
6. The formula we want then is:

$y = 2x + 1$



7. Show your work to find the equation of the line that goes through the given point with the given slope. You *might* want to use the graph at the right to help to picture it the first few times.

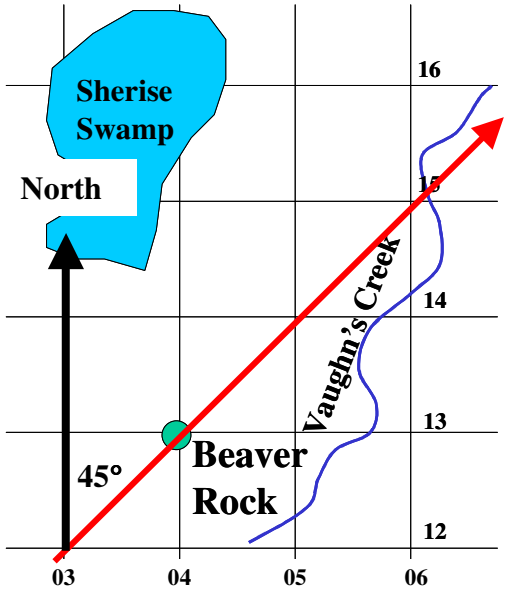
Line	Point	Slope
A	(-3, -3)	1
B	(-4,-8)	1/4
C	(-6,-4)	2.5
D	(-8, 6)	-4
E	(-17.5, 33.145)	2



Answers: **A: y = 1x + 0 = x;**
B: y = x/4 –7; C: y = 2.5x + 11;
D: y = -4x - 26; E: y = 2x - 68.145

Your work to get the above solutions:

8. Advanced Application. (***not for tests***) Your friend calls you on a radio. He is lost out in the bush. He knows he was walking in a *constant direction* exactly on a *compass* direction of 045° all day. He has been using a grid map as shown at the right. He knows he went **exactly by Beaver Rock** *earlier in the day*. It is getting dark. He is afraid of the evil and legendary '***Sherise Monster***' in the night swamp! What is the equation for the line he is following so that you can get *Search and Rescue* to look for him???!!!.



9. **Solution**. You notice that a ***45 °angle*** on a *grid map* has a slope of 1. For every one you go north (***rise***) you go one east (***run***). So you know the slope of the equation is **m = 1**. You also know he went through point **(04, 13)** at **Beaver Rock**.

10. So ***y* = m*x* + b** and **m =1**. So ***y* = 1*x* + b.** But you also know that ***x* = 04**, ***y* = 13** at ***Beaver Rock*** is on the line. So **13 = 1*(04) + b**. So **b must be 9** (*using algebra*). Therefore the equation of his line of travel is: **y = x + 9**. Rescuers can now enter that equation into their computers and navigation systems and moving map displays to find your buddy! ***Well done***, you have saved him from the evil monster of ***Sherise Swamp***!

11. **Advanced Thinking – Not for Tests**. Do you see how direction and slope are related? Notice above that **45°** has a **Tangent** of 1. And **45°** has a line **slope of 1**. Do you think there is relationship (formula) between the trigonometric **Tangent** of a lines angle and the **slope** of a line? Drawing a diagram helps!

PARALLEL LINES – EQUATIONS

12. Any two lines that are ***parallel have the same slope***. They never meet (intersect).

13. Give one equation for a line that is parallel to : ***y* = 3*x*+ 2**.

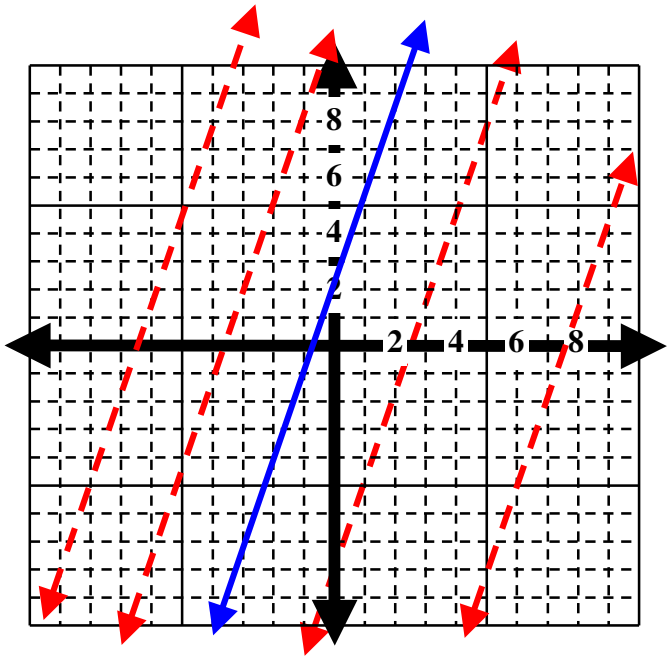
14. Solution. Any line with a slope of 3. So: **y =3*x* + 9** will work!. So will ***y* = 3*x* + 42**. So will ***y* = 3*x* - 77.432**. In fact, there are an **infinite** number of lines that will be parallel to the given line!

15. **Parallel Lines Example**:

Given: ***y* = 3*x* + 2** *(the solid line)*

What lines are parallel? Their slope?

You write a couple equations for lines that are parallel to ***y* = 3*x* + 2**

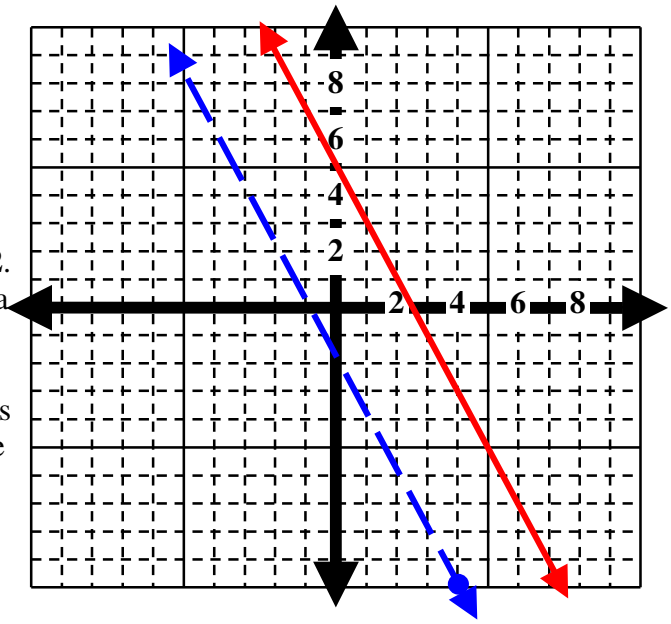


How many of the given parallel lines go through point **(4, 5)** with that slope?

How many of the given parallel lines go through point **(-6, -8)** with that slope?

PARALLEL LINES THROUGH A GIVEN POINT

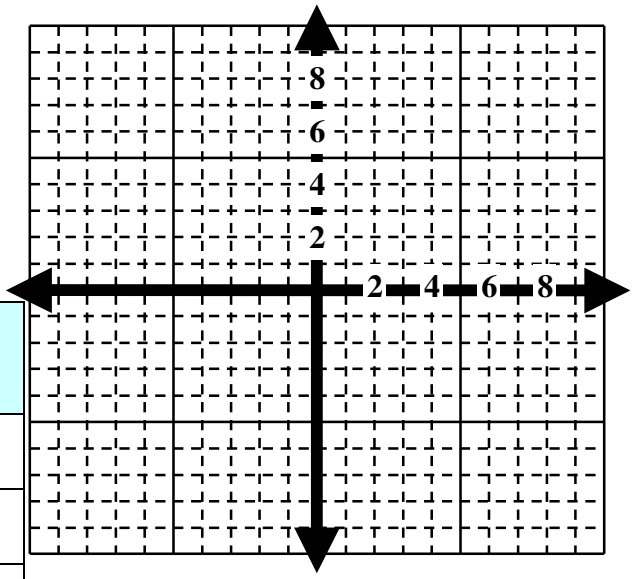
16. **Example**: Find a line that is parallel to the line **y = -2x + 5** [*solid line*] ***and*** goes through the point **(4,-10).**



17. **Solution**. We know the **slope is –2**. And we know how to find the equation of a line through a given point with a given slope! We know the equation of the parallel line is ***y* = -2*x* + b**. (since the slopes are the same). We also can find **b**, because we are given an **x** and a **y** on the line. So : **-10 = -2(4) + b**. Therefore **–10 + 8 = b**. Therefore **b = -2**. So the equation is **y = -2x - 2**. [*dashed line*]

EXERCISE

18. Given the following lines plot each one; then calculate, record in the table, and graph the lines that are parallel and go through the given point. Make the parallel line a broken (dashed) line.



Line	Line Equation	Through Point:	Parallel Line Eqn
A	y = x + 2	(5, 0)	
B	y =-3x+9	(3,-10)	
C	y=2x	(2, 8)	
D	y= -2x	(-2, 8)	

Check your answers on a TI 83 Graphing calculator if you are getting tired of manual graphing. Use the **Y=** screen to enter your formulas.